ANOTEC INDUSTRIES

What is Recommended spacing for Anotec Anodes	Rev 0.0	Apr 3, 2007

A simplified answer by example: There is no perfect spacing in nature. Spacing should depend on:

1. The amperage discharged off each anode.
2. The surface area and resistivity of the coke column. (This example assumes that it is for a deep well)
3. The resistivity and characteristics of the backfill and soil.

1). Amperage off a 90 lb Type 3884Z anode with 5.3 sqft of area.

- Assume 0.75lb/A-yr consumption rate and 85% Utilization available
- Material useful for CP = 90 lb x 85% = 76.5lb
- Divided by 0.75 lb/A-yr = ~100 A-Years equivalent to a 20 year life at 5 amps

Note: 0.75 lb/A-yr consumption is reasonable at nominal current density of ~1 A/sqft anode to coke.

Refer to Article 24 in www.anotec.com for current density and consumption for high silicon cast iron.

2). Surface Area of Backfill: (Assuming that it is for a deep well)

Safe Average Current Density Limit (coke to soil) = 0.150 A/sqft: T. H Lewis, Deep Anode Systems, Loresco, p 52.

Warning: In Clay containing soils susceptible to electro-osmotic drying lower discharge densities are called-for.

Refer to web Article 13 in www.anotec.com, with reference to Hewes, F.W (L09).

Backfill Surface required per anode: = 5 amps / 0.150A sqft = 33.33 sqft of coke surface per anode.

In terms of: Backfill diameter (Area/ft) > SPACING :

- Dia 8” (2.1 sqft/ft) > 16ft spacing
- Dia 9” (2.4 sqft/ft) > 14ft
- Dia 12” (3.1 sqft/ft) >10.5ft

Some other considerations for deep well backfill:

- Extension below bottom anode
- Top extension and consumption allowance
- Venting
- Lewis’s Deep Anode Systems

3). Resistivity of Backfill, and **Resistivity and Electro-Osmotic tendencies of Soil(s)**

This subject can get excessively technical. Later on, go to website Article 34. Meanwhile, to keep things simple:

As the **Resistivity of Soils** decrease relative to **Backfill Resistivity, the more severely CP current concentrates near the anode and drops off midway between anodes (attenuation).** Call all this ***Current Density Peaking.***

The greater the severity of *Peaking*, the more likely that electro-osmosis will dry out the soil at peak locations. As soil dries out, resistivity increases. Although increasing resistivity will “spread out” current from peaks to adjacent soil, it may not be sufficient to stop drying from progressing overall.

Electro-osmotic drying may be mitigated by (a) reducing current output (compromising CP) or (b) by watering the well. But occasionally ground beds cannot be recovered this way. Moreover, the *Safe Average Current Density Limit* of 0.150 A/sqft given in point 2 will not guarantee success in worst-case situations. Hewes calls for lowering current density to soil to 0.064 A/sqft for clay-containing soils with >3000 ohm-cm resistivity. (website Article 13)

One way to reduce the effect of *Peaking* is to use more anodes with proportionally reduced amperage. Another way is to use lots of good-quality, low-resistance backfill. 400 to 600 lbs per anode has worked in difficult conditions in Canada.

For greater understanding of these phenomena, look for future Anotec Articles in Anotec’s website (~ 2 months hence) relating to the distribution of current density to soil from deep well columns.